# CHAPTER 7 HUMAN POPULATIONS

## Chapter Overview

Human population growth is an integral concept in AP Environmental Science. The societal, cultural, religious, and economic factors that affect population growth basic ideas that appear quite frequently on the AP exam. Demographic transition, or the changes in birth rates and death rates as a country goes from pre-industrialized to industrialized, must be learned. It is important for AP students to know the details of each stage (changes in birth/death rates) and why this is happening. The importance of the education of women and women's empowerment are key concepts. Finally, knowing how governments influence population growth is essential.

## Topics and Key Concepts

**Population**

- Trace the history of human population growth.
- Discuss the impact Thomas Malthus had upon the understanding of population dynamics.
- Establish links between demographic transition and the spread of the HIV virus in third world countries.
- Differentiate between total fertility rate, life expectancy, and dependency ratio.
- Explain several impacts of a birth dearth on a nation.
- Diagram the stages of demographic transition, including the changes in BR and DR and the changes in technology and medical advances.
- Discuss the role of women in a nation's ability to control birth dates.
- Summarize different perspectives on population growth.
- Calculate population growth using models provided in the chapter, using births, deaths, immigration, and emigration values.
- Calculate the growth rate 'r' using the Rule of 70.

## Key Terms

birth control
*birth dearth
crude birth rate
crude death rate
*demographic transition model
demography
dependency ratio
family planning
life expectancy
population momentum
*post-reproductive age
*pre-reproductive age
*rate of natural increase
*reproductive age
social justice
total fertility rate
total growth rate
zero population growth (ZPG)

** These key terms are not boldfaced in the chapter text, but are still important for the AP Exam.*

## Pacing Guide

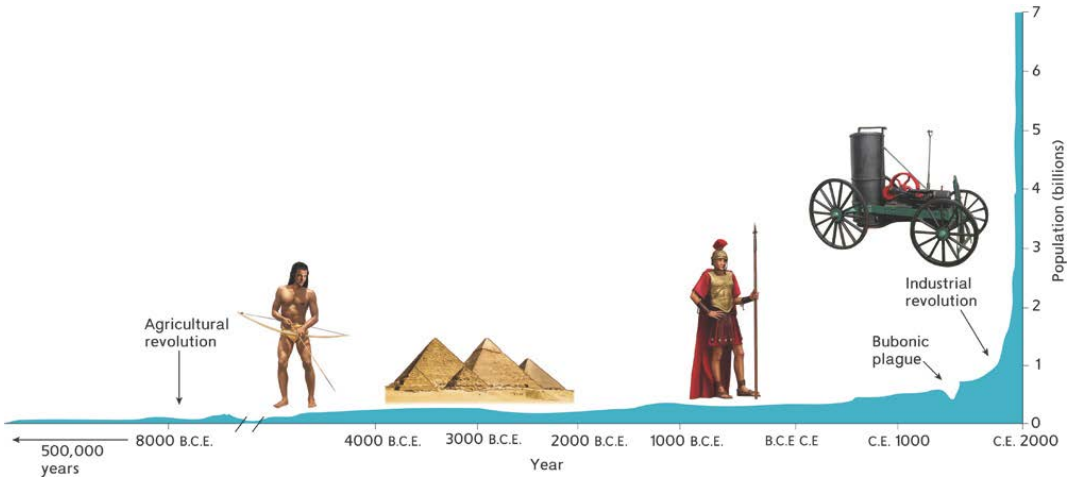
The Acorn outline suggests 10 to 15 percent of the class be used to study populations and demographic transition. Students will need to be able to apply sociological information in a scientific format as religion and culture, sanitation and disease, and the accessibility of food and nutrition all play a role in human demographics. Plan to spend 7–10 days on this chapter.

## Approach and Tips

What factors determine population growth and size? In human populations, social science plays a large role in addition to biological factors as stated above, religion and culture, sanitation and disease, and accessibility of food and nutrition all play a role in human demographics. Have we exceeded the carrying capacity of the world? Discuss specifics on how humans have been able to increase their own carrying capacity, and are the only species which is able to do so. Are we on the verge of doing so? Will technology and other scientific advancements be enough to maintain the human population as it continues to grow? There is a lot of information in this chapter. There is even more if you go into the social science aspects of human population growth. Much of this information can be controversial, so it may be best to limit class discussions to the scientific aspects of the topic.

Begin with a discussion of human population levels through history, as illustrated by figure 7.3, taking particular note of two important occurrences in history, the First Agricultural Revolution and the Industrial Revolution. Use these events to explain the two big increases in human population. Students should be able to explain some of the reasons why population has increased during these two times in history. Thomas Malthus predicted that food supply would run out and that human population would increase exponentially. Ask students why this did not

happen. You can take the opportunity to introduce the concept of neo-Malthusian economics at this time.




A wonderful video from NOVA is called World in the Balance, which is available on the PBS webpage. It comes with teacher guides and activities. It was originally broadcast on April 20, 2004 and most of the information in the video still pertains to the developing world. Many students think that this is one of the best and most unforgettable videos they have seen. Another good video is from Frontline CNN called The People Bomb. This video has several vignettes from countries around the world. It clearly illustrates how culture, religion, and social values play a role in population growth.

Have students graph the data given in table 7.1 (p. 134), World Population Growth and Doubling Times.

**Table 7.1 World Population Growth and Doubling Times**

| Date | Population | Doubling Time |
|---|---|---|
| 5000 B.C.E. | 50 million | ? |
| 800 B.C.E. | 100 million | 4,200 years |
| 200 B.C.E. | 200 million | 600 years |
| 1200 C.E. | 400 million | 1,400 years |
| 1700 C.E. | 800 million | 500 years |
| 1900 C.E. | 1,600 million | 200 years |
| 1965 C.E. | 3,200 million | 33years |
| 2004 C.E. | 6,400 million | 58 years |
| 2050 C.E. (estimate) | 9,710 million | 155 years |

*Source: United Nations Population Division, U.S. Census Bureau*

Continue with a discussion on the demographic transition patterns seen in less-developed countries, compared to those of developed countries. Be sure that you cover each stage with specific detail. Stage 1 Pre-Industrial: characterized by high birth rates and high death rates because of food shortages, malnutrition, lack of sanitation and medicine. Stage 2 Transitional: characterized by declining death rates but birth rates remain high due to more money and better nutrition and sanitation. The four conditions necessary for demographic transition are improved standard of living, reduced mortality of children, improved social status of women, and increased availability and use of birth control. Stage 3 Industrial: characterized by continuing decline in death rates and declining birth rates primarily due to people seeing that all their children are more likely to survive and that the whole family benefits by concentrating more resources on fewer children. Stage 4 Post-Industrial characterized by low birth rates and low death rates. This stage represents conditions in developed countries with access to health care, birth control, clean water and good sanitation. Make sure that the students understand how and why birth rates and death rates change.

Once students have grasped this information, move on to a discussion of the age structure graphs (histograms). Ask students to explain what each graph might look like in the next 10–50 years. Assign students countries to research and have them explain where their country is in terms of development and determine the age structure graph in the future. Another activity is that you can have the students collect data from their families and pool their data. Graph the data by hand so that students are able to practice skills needed for the AP exam. Compare your population pyramid to the current U.S. population pyramid.

It is important for students to differentiate between developing and developed countries. Having students give examples of each and having them explain why each country belongs to that category is important. Using population pyramids or age structure diagrams, students can understand the difference between developing and developed countries, whether or not a country exhibits fast growth or slow growth. Wide based pyramids are indicative of countries with fast growth or developing countries, while a pyramid that is more rectangular in shape would indicate a developed country with slow or no growth. Being able to understand and interpret population pyramids is an essential skill for the AP exam. Students should also be able to infer the IMR, TFR, infectious disease morbidity, role of women, availability of family planning, child labor, and life expectancy from the diagrams.

Finally, make sure that the students can relate social, economic, political, religious, and/or cultural values to population growth. Emphasize how educating women and the empowerment of women affects population growth and family size. Family planning and the future of world population growth should be discussed.

In addition, China's one child policy and the recent change in the policy, as well as the policies of Mexico and India, among others, should be discussed. Students should learn what a "birth dearth" or greying population, does to a nation's social, political, and economic structure.

## Common Mistakes and Misconceptions

Spend significant time here to make sure the students know how to solve for population size; read age structure graphs; know the difference between developing, and developed countries with application to population pyramids; and can read and interpret demographic transition graphs. Students think that the age cohorts on the age structure diagram indicate movement, when the diagrams are actually snapshots in time. Be sure to reiterate this as you continue to discuss the various features which determine a post-industrial, developed, and developing nation.

## Activities

### Population Issues in China and India

Overview:
The two most populated countries in the world are China and India, but they have taken very different approaches to population control. Students will gather population statistics and determine whether from a population standpoint (excluding moral and ethical issues), India should adopt a one-child policy like the one implemented in 1979 by the Chinese government.
Have students follow the two steps below and complete the worksheet located at the end of this teacher's manual chapter.

1. Go to the world factbook on the CIA's website and select the country, China.
2. Complete the data table below for China and then repeat steps 1 & 2 for India and the United States.

### Population Pyramid Activity

This is an internet activity.
1. Go to the U.S. Census Bureau website and find the international database page.
2. Assign students to graph the population pyramid of a developing and a developed nation. Students can find this data by selecting "report" via the drop-down menu. Assign countries to students, or have them draw from a hat. Afghanistan, Qatar, and Germany make excellent example nations. Find the population pyramid of a developing country.

3. Have students explain their pyramids to the class, including how they know it is a developed or developing nation, and what inferences can be made about the population.
4. Have students find the growth rate and determine the doubling time. They can also find the pyramid shape in the future, say in the year 2050, by clicking that date on the Census home page.
5. Have the students explain why these projections are shaped this way. What social, economic, religious, political, and /or cultural values have influenced these projections?

Further Extension
Students should be provided with birth and death rates of various countries in order to calculate population growth rates. Using their answer, students can then calculate doubling times for each country and compare their answers with the U.S. Census Bureau. The following formulas should be used and practiced in class.

$$\text{Rate of Natural Increase} = \left\{ \frac{(BR+IR) - (DR+ER)}{1000} \right\} \times 100$$

Doubling Time (years) = 70 / Population Growth Rate (%)
(Rule of 70)

## Questions for Review

1. What role does education play in the number of children in a family? *Women with higher levels of education generally have fewer children. This may be because women decide that it is better to raise fewer children with more opportunities, or because more education means more women are entering the workforce.*

2. How do the following key factors influence population size: immigration policy, family planning, economic rewards and penalties, and empowering women? *Immigration policy can either increase or decrease population depending on the policy. Family planning and availability of birth control reduces population growth. Economic rewards and penalties can have a positive and negative effect on population. Empowering women provides women with choices beyond raising children, reducing the population growth rate.*

3. A country has a birth rate of 48 per 1,000 and a death rate of 16 deaths per 1,000. Would you say this is a developing country or a developed country? Explain.

*Both of these numbers indicate that this is a developing country. The very high birth and high death rate are indicative of a developing country. This is due to a number of factors, such as, poor health care, lack of sanitation, poor drinking water supply.*

4. What is the correlation between annual income and life expectancy?
   *The higher the annual income the longer the life expectancy. This is due to the fact that individuals with higher incomes usually have health insurance and better access to health care.*

5. What is infant mortality rate? Why it is considered a good indicator of quality of life?
   *Infant mortality rate is the number of infants up to age 1 that die per 1000 live births. The lower the infant mortality rate the more affluent the country.*

6. What are the four stages of demographic transition? Do birth/death rates increase, decrease or stay the same in each stage? Why do the birth/death rates change as they do?
   *Stage 1 Pre-Modern characterized by high birth rates and high death rates because of food shortages, malnutrition, lack of sanitation and medicine. Stage 2 Urbanizing/Industrializing characterized by declining death rates but birth rates remain high due to more money and better nutrition and sanitation. Stage 3 Mature/Industrial characterized by continuing decline in death rates and also declining birth rates primarily due to people seeing that all their children are more likely to survive and that the whole family benefits from concentrating more resources on fewer children. Stage 4 Post- Industrial characterized by low birth rates and low death rates. This stage represents conditions in developed countries with access to health care, birth control, clean water and good sanitation.*

## Practice Questions

Multiple Choice:

*Directions for questions 1-5:* The lettered choices below correspond to the descriptions given in questions 1-5. Select the one lettered choice that best fits each statement. Each choice may be used once, more than once, or not at all.

(A) total fertility rate
(B) crude death rate
(C) crude birth rate
(D) IPAT
(E) natural increase

1. the number of births per 1000 persons

2. the average number of children born to a woman during her reproductive lifetime

3. the number of deaths per 1000 persons

4. crude birth rate – crude death rate

5. highest among women in developing countries

*Directions:* For each of the following questions, select the one lettered choice that best answers the question.

6. This country's population pyramid would have a wide bottom and a very narrow top.
   (A) Kenya
   (B) United States
   (C) Great Britain
   (D) Italy
   (E) Japan

7. In the year 2000, a country has a population of 100,000 people. The growth rate is 3.5%. In what year will the population be 400,000?
   (A) 2010
   (B) 2020
   (C) 2030
   (D) 2040
   (E) 2050

8. Which of the following is/are true of demographic transition?
    I. during stage one, birth rates drop continuously
    II. during the post-industrial phase both birth and death rates remain low
    III. demographic transition is currently occurring in every country
    (A) I only
    (B) II only
    (C) III only
    (D) II and III
    (E) I, II and III

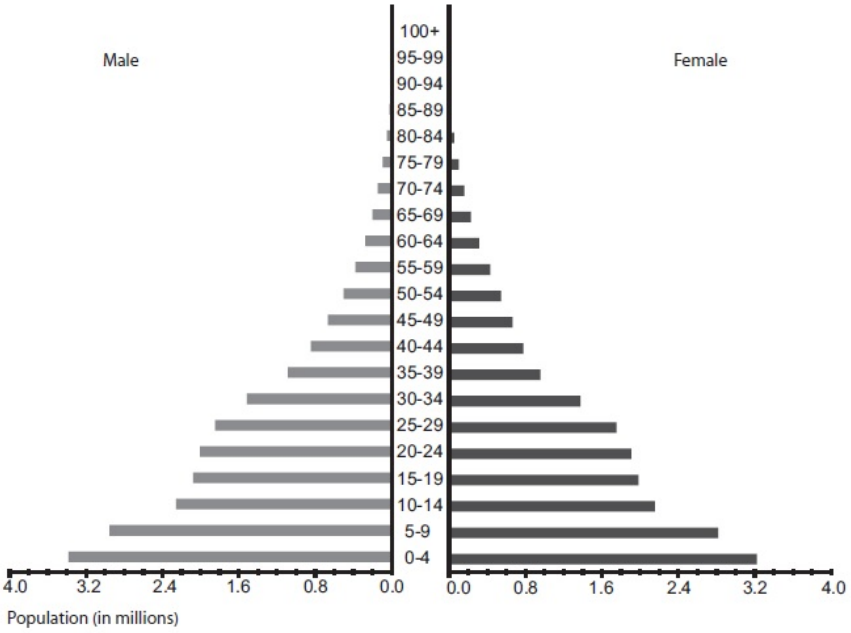
9. Of the following reasons, which one accounts for the largest drop in total fertility rate?
    (A) Women's education and empowerment
    (B) Cultural beliefs
    (C) Religion
    (D) Societal views
    (E) High infant mortality rate

10. The first dramatic increase in population took place during the following time period.
    (A) the Industrial Revolution
    (B) the Green Revolution
    (C) the Second Agricultural Revolution
    (D) the First Agricultural Revolution
    (E) during the twentieth century

Free-Response Question:

*Directions:* Answer all parts of the following question. Where explanation or discussion is required, support your answers with relevant information and/or specific examples. When a calculation is required, be sure to show how you arrived at your answer.

1. Use the following diagram to answer the following questions.




Adapted from U.S. Census Bureau, International Data Base

(a) Approximately how many people are under the age of 35?
(b) This is an age structure diagram for a developing country. What type of growth does this country demonstrate? Name a country that this graph could represent.
(c) Identify and describe TWO factors that account for this type of growth [must match your answer in part (b)].
(d) Explain TWO practices a government could implement to slow population growth.

**Answers to Practice Questions**

Multiple Choice:

1. C
2. A
3. B
4. E
5. A
6. A
7. D
8. B
9. A
10. D

Free-Response Question:

This question is based on 10 points.

1. (a) 2 points total. 1 point for the set-up and 1 point for the correct answer within a reasonable range.

   1.6 + 1.9 +2.0 + 2.1 +2.3+3.0 +3.4 + 1.4 +1.8 + 1.9 +2.0 + 2.1 + 2.6 +3.2 = 31.3 million

   (b) 2 points total. 1 point for indicating this is fast growth and 1 point for naming a developing country, such as, Kenya or Pakistan.

   (c) 4 points total. 1 point for each identification and 1 point for each description.

| Identify | Description |
|---|---|
| cultural beliefs | more children make a family rich/full |
| religious beliefs | no birth control |
| availability of contraceptives | no birth control available |
| high infant mortality rate | continue to have children with the hope that a few will survive |
| necessity of children | either to work in the fields or to care for the elderly |
| economic | children needed to work for income |

(d) 2 points total. 1 point for each practice. Any feasible practice, such as, China's one child policy, tax incentives, education incentives, free access to contraceptives.

## Answers to questions in the Student Edition:

### Case Study AP Document-Based Question (page 132)

(A) Urban populations emit more carbon dioxide than rural populations, and they use more energy resources. Cities in developing countries like China and Brazil often use coal power, which emits a lot of pollutants. Urbanization also changes global climate patterns, because cities radiate heat back into the environment at a different rate than rural areas, and overall cities are warmer than the countryside. This alters both climate patterns and hydrologic cycles.

(B) Urban populations consume more food and energy than rural populations which puts increased pressure on rural areas for food resources. Increased urbanization can affect biodiversity through habitat destruction and fragmentation as global hotspots of biodiversity are being destroyed for the development of cities.

(C) Low population growth combined with an aging population can have a great impact on a country's demographic. An aging population puts increased pressure on younger individuals to support the aging people. Older populations require more social support, which requires more revenue from the working population. If the growth rate is low and there are less working people than older people the younger working population may struggle to support the older population. Countries with older populations may be less innovative than younger populations, because younger people are more adaptable and open to new industries and technologies.

### Use the Math (page 137)

More-developed regions reached the 1750 population level of less-developed regions around 1950. The population growth of less-developed regions, like graphs of carrying capacity, is logarithmic.

## AP Connections Review Answers (pages 150-151)

### Multiple-Choice

1. e. Using the rule of 70, 70/1.5 = 46.67 years. 2100 is approximately 90 years from now, roughly two doubling times. The population of a country is 10 million people. Therefore the first doubling would produce 20 million, and the second doubling would result in a population of 40 million people by 2100.

2. d. More contraceptives must be available for a woman to control her reproductive rights. The marriage age should be higher to lower the TFR. Education opportunities and holding an equal position in the community as men (able to vote and own property) will allow the country to proceed to the industrial phase. By decreasing the availability of abortions in a country, women are sometimes forced into unwanted pregnancies.

3. d. Populations entering the industrial phase of demographic transition exhibit declining birth and death rates, low infant mortality rates, access to medical care, and readily available birth control.

4. a. There are more males than females in the pre-reproductive cohort because males are preferred in China.

**Data Analysis and Free-Response Questions**

1A Singapore is split between 36-40 and 41-45. Niger is 21-25.

1B Sweden has the largest percentage of post-reproductive males. The approximate percentage for each age bin is 2%.

2A With high HIV infection rates, there are less adolescents in the population that become reproductive adults (AIDS is the number one cause of death for adolescents) and a large percent of adults (almost a quarter of the population) die before their life expectancy so there are less retired or elderly people.

2B The economics of a nation are impacted by losses or increases of people in the reproductive age cohort because 1) changes in the number of reproductive age people usually means changes in the number of infants and young children. There are costs associated with human populations such as food supply and lack of food can lead to crime or increased food prices. The economics could also be changed by 2) more reproductive age people means more working-age people that can help the economy through working and providing services to the community.

2C There is often a higher infant mortality rate in developing nations because of lack of access to nutritious food, adequate healthcare, and immunizations to prevent disease.

## Population Pyramid Activity Worksheet

*Student:*_____

| | CHINA | INDIA | UNITED STATES |
|---|---|---|---|
| Life Expectancy | | | |
| Population Size | | | |
| Per Capita Income | | | |
| Birth Rate | | | |
| Death Rate | | | |
| Literacy Rate | | | |
| Infant Mortality Rate | | | |

Conclusions:

1. What do these numbers reveal about China and India? Support your answer from the data.

2. Should India have a one-child-only policy like China? Why or why not?

3. Are there economic reasons to support having smaller families? Larger ones?